



## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Vishnu K. Agarwal

Attorney Docket No.: 500431.04

Serial No. : 09/910,661

Group Art Unit : 1763

Filed : July 20, 2001

Examiner : George Goudreau

Title : METHOD AND APPARATUS FOR ENDPOINTING A CHEMICAL-MECHANICAL  
PLANARIZATION PROCESSBox Non-Fee Amendment  
Commissioner of Patents  
Washington, D.C. 20231

RECEIVED

FEB 04 2002

DECLARATION UNDER 37 C.F.R. § 1.131

TC 1700

Sir:

I, Vishnu K. Agarwal, declare the following:


1. I am a named inventor on the above referenced patent application.

2. I have been employed as an engineer for Micron Technology since  
June 18, 1997.

3. Prior to September 4, 1997, I conceived of the apparatus for detecting the endpoint of a planarizing process of a microelectronic substrate which is claimed in the afore-mentioned patent application. More particularly, I conceived of directing slurry coming out of a planarization pad to a vaporizer using a pump along with an optional filter or diluter. The vaporized slurry is then analyzed for the species of interest in a mass spectrometer, and a change in slurry concentration as determined by the mass spectrometer is used for controlling the planarization process. Transport of the slurry from a drain line from the planarizing platen, vaporization, analysis and communication of the mass spectrometer results to the controller of the planarization process can take less than two seconds.

4. Prior to September 4, 1997, and within four days of conceiving of using a mass spectrometer to detect a change in slurry concentration and control a planarization process, I prepared Invention Disclosure Statement No. 97-800 which set forth the foregoing inventive idea. The invention disclosure statement was submitted to my employer, Micron Technology, Inc., for the purpose of preparing a patent application. The invention disclosure statement was thereafter submitted to patent counsel for preparation of the present application. A copy of the invention disclosure statement submitted to my employer and to patent counsel is attached hereto as Exhibit A.

5. The aforementioned statements based on my own knowledge are true and/or are based on information believed by me to be true. I acknowledge that willful false statements and the like are punishable by fine or imprisonment, or both, and may jeopardize the validity of the subject patent application or any patent issuing thereon.

  
Vishnu K. Agarwal

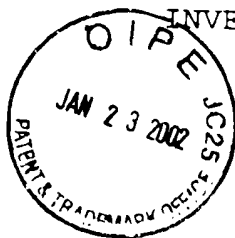
11/28/2001  
Date

\\Sefile05\Files2\IP\Documents\Clients\Micron Technology\400\500431.04\500431.04 1.131 Declaration VK Agarwal.doc

object,  
check below:

INVENTION DISCLOSURE

97-800



Advanced SRAM

BST

FED

FE RAM

NCAICM

INVENTOR(S): Vishnu K. Agarwal

DESCRIPTION

RECEIVED

FEB 04 2002

TC 1700

2.1 Title of invention:

A method for the on-line end point detection of CMP.

2.2 Brief description:

In this invention a method for the end point detection of CMP process is disclosed. A continuous sample of slurry, coming out of the pad, is directed to vaporizer using a pump/ pump and filter combination/ pump and dilution. The vaporized slurry is analyzed for the species of the interest in mass spectrometer. The change in slurry concentration as determined by the mass spectrometer is used for the controlling the process.

2.3 Also attach a complete description, including drawings or sketches and articles relevant to the invention. Legible photocopies of laboratory notebooks are acceptable.

Figure 1 shows the block diagram of the detection system after integration with the CMP tool. This figure also indicates the time taken in each step. The transport of the slurry from the drain line, vaporization, concentration analysis are performed and subsequently communicated with the controller on CMP tool in less than 2 second. This is continuous concentration monitoring hence no stabilization time is associated in region of interest as indicated in figure 2.

The concentration of W, Al, Cu and Si in slurry with various combination of removal rate and slurry flow rate is given in table 1. The data in this table show that the concentration level under various possible conditions is well within the capability of the mass spectrometer.

INFORMATION CONCERNING CONCEPTION OF INVENTION

3.1 CONCEPTION AND DOCUMENTATION OF THE INVENTION

EXHIBIT

A

FIGURE -1 : BLOCK DIAGRAM OF END POINT DETECTION SYSTEM  
USING VAPORIZER AND MASS SPECTROMETER

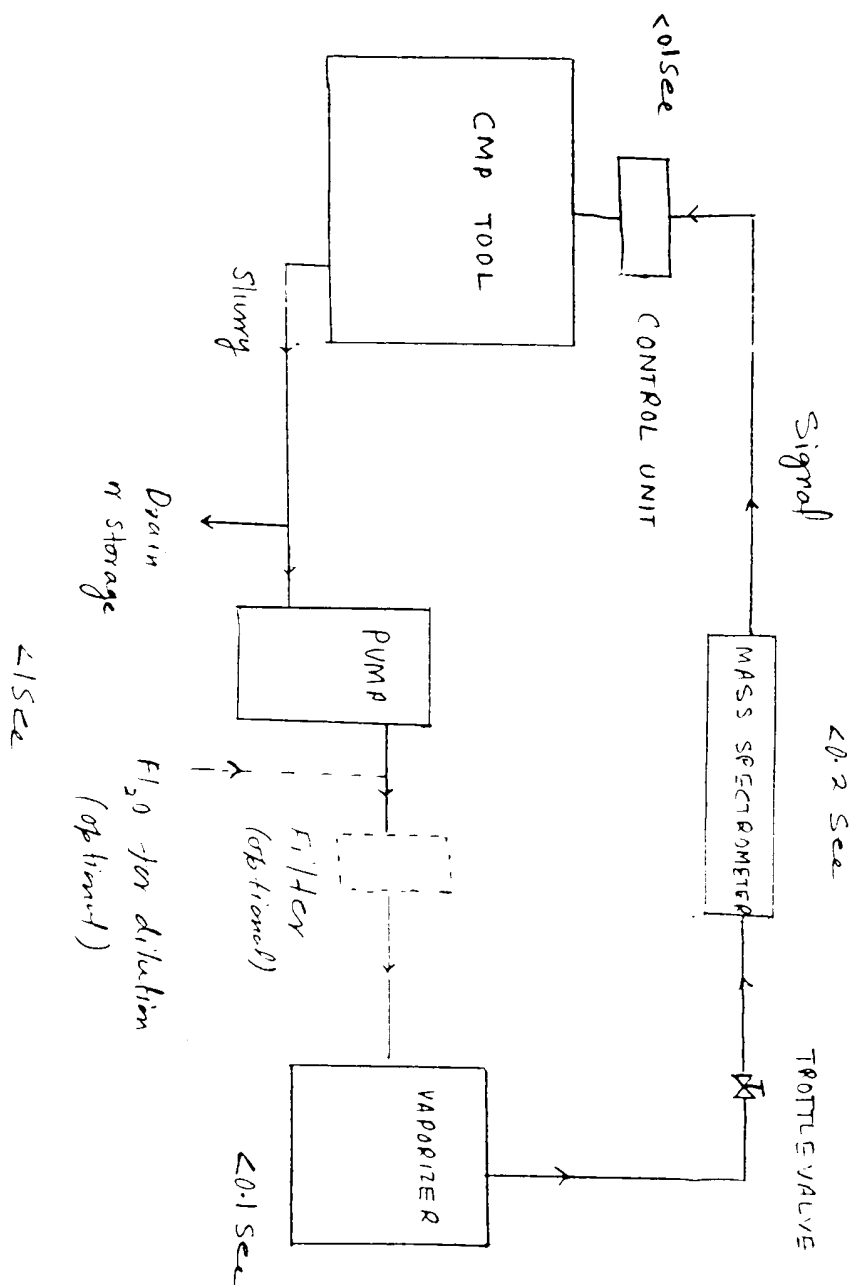
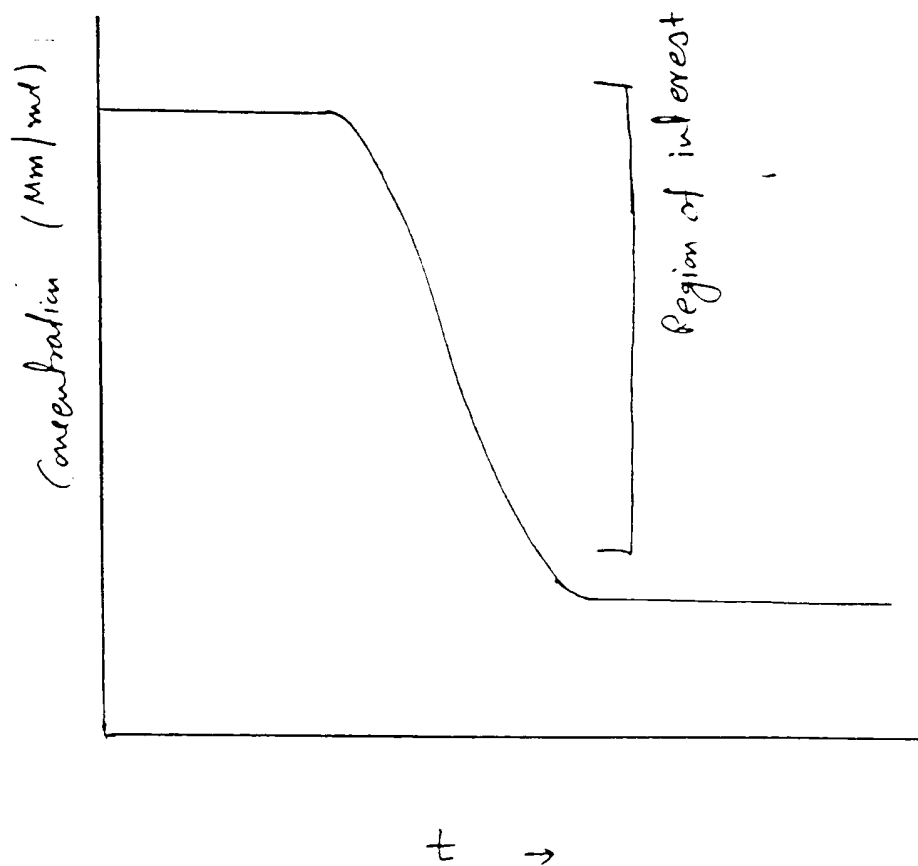


FIGURE-2 CHANGE IN CONCENTRATION DURING END POINT



**Table-1 : Concentration of various species under different processing conditions**

P-removal Rate (A/sec)	Slurry flow rate (ml/min)	Material being removed	Concentr ( $\mu\text{g/ml}$ )
10	10	W	1477.
10	500	W	29.5
10	10	Al	206.7
10	500	Al	4.13
10	10	Cu	682.9
10	500	Cu	13.6
10	10	Si	153.1
10	500	Si	3.06
100	10	W	14776
100	500	W	295.5
100	10	Al	2067.
100	500	AL	41.3
100	10	Cu	6829.
100	500	Cu	136.5
100	10	Si	1531.
100	500	Si	30.6

option : Wafer Size is 8"

- a. Identify the date when you first conceived the invention. (If not sure, give the earliest date of which you are sure.)
- b. To whom was the idea first described and on what date? (Other than a co-inventor.)
- Dr. Gurtej Sandhu,
- c. Identify the date of the first tangible record such as computer simulation, tape out, drawing or written description. Please specify type and location.

## 2. CONCEPTION OF THE INVENTION

- a. Please identify related invention disclosures, patents or other publications describing similar ideas, and other companies working in the same field. Attach copies, if available.

No patent or publication mentioning this method for the CMP end point detection is not in my knowledge.

- b. What is the closest technology, of which you are aware?

Chemical analysis method other than this method.

- c. Identify the advantages of this invention over previous technology.

On line and real time analysis, The point of interest can find out and communicated in less than 2 sec.

Little time for development. The pump and vaporizer are available commercially used for DLI in CVD. The mass spectrometer is also available commercially from various manufacturer.

Compatiable with the clean room.

Can be used for any type of CMP and for various recipes.

Highly sensitive.

## 3.3 IMPORTANT DATES

- a. Has the invention been disclosed outside the company? No  
If yes, to whom, when, and in what form?
- b. Have any articles describing your invention been published?  
No If yes, list author(s), title of article, publication and date.
- c. Have any engineering samples been given out? No If yes, to whom and on what date?
- d. Has any product using the invention been sold or offered for sale? No If yes, to whom and on what date?

## 3.4 DISPOSITION OF THE INVENTION

- a. When will (or did) Micron begin use of the invention



experimentally?

- b. When will (or did) Micron begin production of this invention?

3.5 MISCELLANEOUS INFORMATION

- a. Was the invention developed during a joint development agreement or other contract with an outside company? No
- b. Please list developmental work outside of the company (including Government proposal or contract). Not applicable

INVENTORS:

ame: Vishnu K. Agarwal

Micron Phone: 82919 Micron Mail Stop: 306

Company Name (VERY IMPORTANT): Dept. Name: Fab4/Diffusion/R&D  
 \_X\_ Micron Technology, Inc. Dept. #: \_894G  
 \_\_\_ Micron Electronics, Inc.  
 \_\_\_ Micron Quantum Devices  
 \_\_\_ Micron Display Technology, Inc.  
 \_\_\_ Micron Communications, Inc.  
 \_\_\_ Other

Home Address: 2463 E. Red Cedar Lane, # 103  
Boise, ID-83716

Citizenship: India

Supervisor: \_\_\_\_\_Dr. Gurtej S. Sandhu\_\_\_\_\_

Signature: W. Agnew Date: \_\_\_\_\_

Name: \_\_\_\_\_

Micron Phone: \_\_\_\_\_ Micron Mail Stop: \_\_\_\_\_

Company Name (VERY IMPORTANT):                      Dept. Name: \_\_\_\_\_  
     \_\_\_ Micron Technology, Inc.    Dept. #: \_\_\_\_\_  
     \_\_\_ Micron Electronics, Inc.  
     \_\_\_ Micron Quantum Devices  
     \_\_\_ Micron Display Technology, Inc.  
     \_\_\_ Micron Communications, Inc.  
     \_\_\_ Other

Home Address: \_\_\_\_\_

Citizenship: \_\_\_\_\_

Supervisor: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name: \_\_\_\_\_

Micron Phone: \_\_\_\_\_ Micron Mail Stop: \_\_\_\_\_

Company Name (VERY IMPORTANT): \_\_\_\_\_ Dept. Name: \_\_\_\_\_

☐ Micron Technology, Inc. Dept. #: \_\_\_\_\_  
☐ Micron Electronics, Inc.  
☐ Micron Quantum Devices  
☐ Micron Display Technology, Inc.  
☐ Micron Communications, Inc.  
☐ Other \_\_\_\_\_

Home Address: \_\_\_\_\_

Citizenship: \_\_\_\_\_

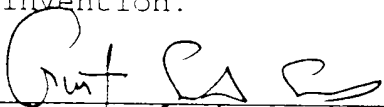
Supervisor: \_\_\_\_\_


Signature: \_\_\_\_\_ Date: \_\_\_\_\_

-- If more than three inventors use additional form(s) available in the Legal Department, 3rd floor, Administration building. --

5. WITNESS

If there is only one inventor, a witness should sign and date this disclosure. A witness in this case is a non-inventor who understands the nature of the invention.

  
\_\_\_\_\_  
(Signature of Witness)

  
\_\_\_\_\_  
(Date)

Note: If you have any questions or wish assistance completing this form, please call the Legal/Patent Department, ext. 4527.